UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Summary Review of Monthly Reports*
for
SOIL CONSERVATION SERVICE RESEARCH
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EROSION CONTROL PRACTICES DIVISION

Orchard Erosion Control - Joseph C. Moore, Auburn, Alabama.-"Due to the rapid expansion of fruit production in Alabama, the problem of soil erosion and maintenance of soil fertility on cultivated orchards has become more and more difficult to solve.

"Returning to nature's methods of controlling erosion and maintaining the soil by the use of trees and permanent ground covers seems to be the best solution to the problem.

"The use of permanent covers in an orchard creates a natural cycle of soil improvement having the following advantages:

1. Prevention of soil erosion.
2. Prevention of excessive run-off of rainfall.
3. Soil temperature reduced by the permanent shade.
4. Improvement of the percolating and water absorption capacity of the soil.
5. Improvement of the soil by the decomposition of the continually falling plant materials, and the increased activity of fungi, bacteria and worms.
6. Protection of the soil against the direct impact of rain and sun.

"Permanent covers planted in young orchards, on exhausted soil, offers a special problem. Competition will be severe during the first two or three years until nature's method of living association is maintained. It is true that trees and covers have similar requirements and a struggle is set up which will not be overcome until the trees reach their predominance for light and moisture supply. This is established when the tree sends down a deep root system and the top reaches above the competing plant cover.

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**All Research work of the Soil Conservation Service is in cooperation with the various State Experiment Stations.

"This natural period of competition can be successfully controlled by regular clipping of the ground cover and the addition of complete fertilizer to the trees.

"Our orchard at Auburn, Alabama under erosion-controlled practices has reached this natural balance and the apples, peaches and plums are making much better growth and producing more fruit than is produced on the clean cultivated area.

Treatment	Average yields of Peaches & Plums	Average size of Peaches
Clean cultivated	126.1 lb.	2.14 in.
Lespedeza sericea cut	135.7 lb.	2.29 in.
Bur clover - Rescue grass (Weeds cut in summer)	137.2 lb.	2.35 in.

"This question often arises - 'What about insect damage where you have permanent covers?' The answer, as we see it, is that the cover makes an ideal sanctuary for birds, which in turn takes care of the additional insects."

Runoff and Erosion Results from the Corn Plots Where Mulch Farming Practices are Being Compared with Conventional Methods - T. C. Peele, Clemson, S. C.-"Data have been summarized in tables 1, 2 and 3 for the most erosive storms that have occurred here during July and August of this year.

Table 1. Influence of cultural practices on runoff and erosion from corn during 1.96 inches of rainfall on July 15, 1946.

Tillage Method	Preceding Cover Crop	Runoff percent	Soil Loss lbs./acre
Mulch, balk method	vetch and rye	1.28	72
Mulch, disk method	vetch and rye	1.38	62
Plowed, clean tillage	vetch and rye	9.95	406
Plowed, clean tillage	None	37.19	2376

The maximum rainfall in 5, 15 and 30 minutes was 7.2, 5.2, and 3.6 inches per hour.

Table 2. Influence of cultural practices on runoff and erosion from corn during 0.60 inches of rainfall on August 7, 1946.

Tillage Method	Preceding Cover Crop	(Percent) Runoff	(Lbs./Acre) Soil Loss
Mulch, balk	Vetch and rye	2.00	None
Mulch, disk	Vetch and rye	4.00	None
Plowed, clean tillage	Vetch and rye	23.33	152
Plowed, clean tillage	None	53.67	586

The maximum rainfall in 5 and 10 minutes was 3.6 and 3.0 inches per hour.

Table 3. Influence of cultural practices on runoff and erosion from corn during 4.46 inches of rainfall on August 21 and 22, 1946.

Tillage Method	Preceding Cover Crop	Runoff	Soil Loss
		percent	lbs./acre
Mulch - balk	Vetch and rye	4.75	173
Mulch - disk	Vetch and rye	9.44	275
Plowed - clean tillage	Vetch and rye	27.65	662
Plowed - clean tillage	None	62.91	1767

The maximum rainfall for 5, 15 and 30 minutes was 3.6, 3.2 and 3.0 inches per hour.

"The results of some of our experimental work with mulch farming were presented to a state meeting of District Supervisors at Clemson August 8. The Supervisors were conducted on a field inspection trip of our experimental work the afternoon of August 8. The runoff water from the storm occurring August 7 was left in the tanks for inspection on August 8, and aroused considerable interest among the Supervisors regarding the effects of mulches on runoff and erosion.

"The corn following winter legumes where the mulch farming and conventional tillage methods are being compared is not as good as it was last year, but will probably average 50 bushels or more of corn per acre. There are no apparent differences at this time in the corn where the different tillage methods have been used."

Runoff and Beef Production From the Three Bluegrass Pasture Areas for 1946 to September 1 - Dwight D. Smith, Columbia, Missouri.-

Area	Runoff		Beef production
	Amount in inches	Percent of rain	lb./acre
Contour Furrowed Pasture	4.43	18.7	91
Renovated Pasture	4.92	20.8	244
Check Pasture	5.22	22.1	118

"During this period the renovated pasture allowed 6% less runoff than the check pasture, whereas from previous records the two areas have allowed equal amounts of runoff. The contour furrows continue to function as previously. They have delayed the beginning of runoff, prolonged the time of runoff, and reduced both amount and maximum rate of runoff. Production from the renovated pasture during the spring and early summer was exceptionally high. This was the first summer when the legumes were exceptionally thick on the area."

Effects of Various Soil Management Practices on Peach Yields in 1946 From Trees Planted in 1939 - John T. Bregger, Clemson, S. C.-

Soil Management Practice	Average Yield in bushels 1946	Percent change from 1945
Clean cultivation (no cover crop)	6.0	15.5 (D)
Grain straw mulch	7.4	8.6 (D)
Sorghum pomace mulch	4.2	12.5 (D)
Lespedeza sericea, perennial cover	4.1	2.5 (I)
Unmowed plots	4.3	2.4 (I)
Mowed plots	3.9	2.6 (I)
Kobe lespedeza, continuous cover	4.65	4.6 (I)
Unmowed plots	4.4	4.8 (I)
Mowed plots	4.7	4.4 (I)
Soybeans-Sudan grass, summer c.c., winter mulch	5.55	3.1 (D)
Unmowed plots	5.2	0
Mowed plots	5.9	6.3 (D)
Vetch (winter c.c.); soybeans (summer c.c.)	7.3	0
Vetch (winter c.c.); crabgrass (summer c.c.)	7.3	2.7 (D)
Rye (winter c.c.); soybeans (summer c.c.)	5.6	13.8 (D)
Rye (winter c.c.); crabgrass (summer c.c.)	5.6	0
Vetch plots; minimum cultivation*	6.9	25.5 (I)
Vetch plots; 1-1/2 months cultivation	7.7	10 (I)
Vetch plots; 3 months cultivation	7.1	23.7 (D)
Rye plots; minimum cultivation*	5.4	22.7 (I)
Rye plots; 1-1/2 months cultivation	6.0	0
Rye plots; 3 months cultivation	5.6	0

*Seedbed preparation only. D-Decrease. I-Increase.

"In comparing the effects of various soil management practices on peach yields, it is plain that the largest differences are to be found between vetch and rye, with clean cultivation falling between. This is undoubtedly a nitrogen relationship since vetch adds nitrogen to the soil while rye removes it. Mowing of an annual cover crop seems to increase the yield somewhat, while the reverse holds true with the perennial cover (L. sericea). Summer tillage showed no significant effect beyond the 1-1/2 months duration. No advantage whatever resulted from use of a legume summer cover crop.

"It will also be seen from an examination of yield data that most of the plots in the experimental orchard (planted 1939) reached their maximum production in 1945. This is the age when there normally should be a leveling off of

production for the orchard as a whole. Space limitation, branch breakage, shading of lower branches, etc. will naturally reduce yields of the best plots first. Treatments which have curtailed tree growth up to the present time have in most cases allowed increased production in 1946. If such trees are to reach the same bearing capacity as trees in the other treatments, they should continue to increase their production for several more years.

"Peach trees are not normally biennial in bearing habit, but occasionally small crops follow extra heavy crops due to a reduced amount of fruiting wood, branch breakage, etc. We have this indication in the attached data where the plots receiving the least cultivation increased their production over last year while those receiving maximum cultivation decreased their production from last year. It may therefore be said that a single year's production does not tell the shole story after trees reach their peak production. A better manner of evaluating treatments after peak production of some treatments is reached will be to use figure denoting total yields to date. Such data are being prepared and will be submitted in a later report."

Runoff and Soil Losses Resulting From June and July Rains on Control Tobacco Plots - T. L. Copley, Raleigh, N. C.-"The results of five principal rains, totaling 12.30 inches, which occurred during June and July have been tabulated and are given below. The heaviest of these rains was 3.44 inches on July 2, and the lightest was 1.74 inches on July 8. The highest intensity was 6.66 in/hr. June 19, and the lowest intensity was 2.64 in/hr. July 8.

CROP	RUNOFF			SOIL LOSS		
	Rep. I	Rep. II	Average	Rep. I.	Rep. II	Ave.
	Percent	Percent	Percent	T/A	T/A	T/A
Tobacco after no winter cover	32	23	27	6.5	6.7	6.6
Tobacco after Rye	33	31	32	5.1	5.7	5.4
Tobacco after Rye, with 24 lbs. Nitrogen at seeding of Rye	34	21	27	6.5	4.2	5.3
Tobacco after Rye Grass	39	26	32	6.3	5.0	5.6
Tobacco after Rye Grass, with 24 lbs. Nitrogen at seeding of Rye Grass.	33	25	26	3.0	2.5	2.7
Tobacco after weed 2-year rotation	30	27	28	9.0	3.7	6.3
Tobacco after Red Top, 2-year rotation	30	33	31	4.9	8.0	6.4
Weeds after tobacco	14	6	10	.27	.07	.17
Red Top after tobacco	25	17	21	.26	.18	.22

"These data, which follow fairly closely previous results, indicate that crop residues ordinarily turned under for tobacco in this experiment have little effect on soil loss during the summer period. Rye grass, fertilized with nitrogen at seeding in the fall and producing a heavy turf, was the only cover crop that reduced soil loss after it was turned. This heavy sod makes the land difficult to prepare for tobacco planting and will be objectionable to most farmers.

"Two main factors are probably responsible for this lack of effect on soil loss: (1) with present methods of tillage, each tobacco row becomes a high ridge and each middle a high speed channel by the last cultivation which encourages rapid runoff, (2) the incorporated residue decomposes quickly in the sandy tobacco soils and has mostly disappeared by the season of hard summer rains.

Practical Use Of The Improved Row Layout In Tobacco Fields - "Tobacco farms in Durham and Orange counties were inspected on August 7, to observe the use of our string method of row layout. In all cases this system of row layout was proving satisfactory and many farmers were adopting it on their entire farm. J. C. Jester, Work Unit Conservationist, reported this as one of his most effective and popular conservation practices.

"One rather striking demonstration was observed in Jones county, in the coastal plain area where row drainage is the main problem. In one field the Soil Conservation Service technicians had laid out guide rows which provided good drainage and resulted in a normal yield of tobacco. In an adjoining field the farmer had used his usual straight rows. Here faulty drainage caused at least one acre to drown, with a loss of over $500.

"These observations indicate that improved row layout is badly needed in the coastal plain area."

Topsoil Depth In Relation To Crop Yields And Soil And Water Losses - Orville E. Hays, LaCrosse, Wisconsin.-"Soil losses for the first 8 months of 1946 have been quite low as no intense storms occurred. The following table summarizes the data from the Control Plots for the eight months period:

PERIOD	Severely Eroded		Moderately Eroded	
	Runoff-Inches	Soil Loss T/A	Runoff-Inches	Soil Loss T/A
		CORN		
1/ 1 - 4/15	6.55	1.35	2.05	0.30
4/16 - 8/31	.01	0	.02	0
		OATS		
1/ 1 - 4/15	9.40	4.87	3.53	5.76
4/16 - 8/31	0.83	1.09	0.43	0.39

"The severely eroded plots have 3 inches of surface soil remaining and the moderately eroded plots have 6.

Yield of Oats Greatly Reduced by Loss of Surface Soil - "The yield of Victland oats on the moderately eroded soil was 100.9 bushels per acre and the yield on the severely eroded soil was 52.4 bushels per acre. The loss of three inches of surface soil reduced the yield 48.5 bushels per acre. This difference in yield occurred even though both plots received fertilizer in amounts necessary to bring the soil to 75# of available phosphorous and 200 pounds of available potash per acre."

Effect of Earthworms on Yield - Henry Hopp, Beltsville, Maryland. - "The following four series of crocks were used in a test on earthworms and yield of millet: (1) no worms. (2) worms for 1 month; then, before planting crop, worms removed and soil reworked; (3) worms for entire period of test; (4) dead worms added at start of test. After a preliminary period of one month, during which time all crocks were kept bare, millet was planted. Average relative weights per stalk when harvested two months after planting were:

Series 1	100 per cent
Series 2	101 per cent
Series 3	146 per cent
Series 4	132 per cent

"The worms in Series 3 had passed through a reproductive cycle. At the end of the experiment, most of the old worms had died and a new crop of younger worms were present. The study indicates that the presence of worms may increase yield where cropping conditions are followed that allow the normal cycle of reproduction and death in the earthworm population."

Grain and Straw Yields of Winter Wheat under Different Dates of Clipping and under Grazing for the 1945-1946 Season - C. J. Whitfield, Amarillo, Texas. - "Four winter wheat varieties, namely, Westar, Comanche, Tenmarq and Blackhull, were seeded on fallow land on August 27 to 29, 1945. Uniform stands were secured for all varieties. Grazing was with steer calves and long yearling steers. Height clipped for grain and straw yields was one inch. Clippings were made in exclosures with livestock excluded except samples taken from grazed pasture. There was a wide difference in grain yields for the various clipping dates. The high yield for all treatments and varieties was 25.9 bushels per acre for Westar, which was clipped for forage production on November 5, 1945 and January 28, 1946. The average yield ranked by varieties for all treatments is Westar 13.0 bushels per acre, Comanche 12.0, Tenmarq 11.9, and Blackhull 9.1. The average for the four varieties ranked by treatments are as follows: Clipped November 5 and January 28, 21.0 bushels per acre; not clipped 17.1; clipped January 28 and March 7, 14.0; moderately grazed November 8 to December 11 and February 4 to April 1, 9.3; clipped November 5 and April 2, 8.5; clipped April 2, 4.7; and clipped March 7 and April 2, 4.3. Clipping or grazing in March or April in 1946 greatly reduced the grain yield in all cases. Early clipping in November and January brought a favorable increase in yield over the not-clipped plots. Since this is the first year of the study, one point must be stressed. It is probable that 1946 will show more adverse effect from late

clipping than any year in a 15 or 20 year period. Spring was exceptionally early, with dry, hot weather, and wheat harvest was two or three weeks early in 1946. The last killing frost was March 23 in 1946, while the 7-year average is April 15. From the yield data, the optimum date for removing livestock from wheat would have been between January 28 and March 7 to obtain the highest grain yield.

"In comparing varieties, one peculiarity is noticed. Blackhull has the low yield in most cases where clipped early but when clipped or grazed late, it ranked as high or higher than the other varieties. Under grazing, it ranked first.

"Straw yields varied greatly with clipping dates but yields between varieties were not as wide as for grain yields, in most cases. The high yield was 2,520 pounds per acre for the Westar plot that was not clipped for forage production. Late clipping greatly reduced straw yield and in about the same proportion as the reduction in grain yield. There was not a significant difference between straw yield for the four varieties from the not-clipped plots and plots clipped November 5 and January 28 which is important. With the conservation and management of residues receiving more attention in wheat production, it is important to know the proper time of grazing and amount of forage that can be removed without greatly reducing the amount of residue left in the form of straw. The straw yield ranked by varieties for all treatments is: Tenmarq 1,550 pounds per acre, Westar 1,504, Comanche 1,400 and Blackhull 1,203. The average straw yield for the four varieties ranked by treatments is as follows: Not clipped until harvest, 2,092 pounds per acre; clipped November 5 and January 28, 2,015; clipped January 28 and March 7, 1,494; clipped November 5 and April 2, 1,213; clipped April 2, 840; clipped March 7 and April 2, 832."

Tillage Methods and Wheat Yield - Carl L. Englehorn, Fargo, N. D.- "The tillage plots at Edgeley were harvested and threshed by the middle of August. Yields of wheat were fair, considering the below average precipitation which occurred during the last two years.

"Moldboard plowing, as a means of tillage for seedbed preparation, produced 16.8 bushels of wheat, the highest yield for this plot series this season. Stubble mulch tillage produced 14.1 bushels. Where 2-ton of straw was added, stubble mulch tillage yielded 15.9 bushels. On the summer fallow series, stubble mulch tillage, both with and without added straw showed a small yield advantage over other tillage. On stubble mulch fallow added straw showed no yield advantage. Fall pitting of plowed fallow showed no additional yield advantage over unpitted fallow. The data are shown in the following tables:

Tillage for spring wheat seedbed preparation and yield of wheat, Edgeley, 1946.

Tillage Method	Yield, bushels an acre			
	1	2	3	Mean
Moldboard plow	21.0	16.7	12.7	16.8
Moldboard plow, pony press	18.2	13.0	14.0	15.1
Burn, no tillage	13.8	13.0	12.1	13.0
2-ton straw, stubble mulch	19.5	15.8	12.5	15.9
Stubble mulch	16.5	13.5	12.3	14.1
Field cultivator	15.3	13.3	12.2	13.6
Disk	14.2	11.9	13.2	13.1

Tillage for summer fallow and yield of wheat, Edgeley, 1946.

Tillage Method	Yield, bushels an acre			
	1	2	3	Mean
Moldboard plow	21.5	20.2	21.2	21.0
Moldboard plow, pit	22.7	21.0	20.0	21.2
Field cultivator	20.7	20.5	21.0	20.7
Stubble mulch	21.5	22.5	22.5	22.2
2-ton straw, stubble mulch	20.0	21.8	24.5	22.1

Wheat Yields in 1946 as Influenced by Tillage and Residue Management Practices - F. L. Duley, Lincoln, Nebraska.-"The small-grain threshing has been completed, and the wheat yields are summarized briefly in the following tables:

Wheat Yields

Rotation Plots	Bu. per acre	Pounds straw
Subsurface tillage, continually	34.2	3545
Subtilled for wheat & oats, plowed for corn	33.6	3535
Plowed for wheat, subtilled for corn & oats	33.5	3590
Plowed, residues under	32.5	3395
Plowed, no straw	31.8	3485

Effect of Sweetclover on Wheat Yields

Tillage	Bushels of Grain per acre		
	Sweetclover	No legume	Increase due to sweetclover
Subtilled-residues	49.2	33.9	15.3
Residue plowed under	50.5	33.0	17.5
Mean	49.9	33.5	16.4

Wheat Yields at Hastings Project

Treatment	Bushels per acre Subtilled	Plowed
Wheat after fallow	27.4	24.8
Wheat after sweetclover	20.1	17.1
Wheat after oats	13.4	10.4

Tillage Methods and Wind Erosion - Torlief S. Aasheim, Bozeman, Montana.-"An excellent opportunity to observe the resistance to wind erosion of various methods of fallow was provided at Culbertson on August 7th. A very strong wind occurred which caused considerable wind erosion on most treatments. The sub-surface tilled plots were the only plots which showed no signs of soil movement. The oneway disced fallow showed some evidence of erosion but was definitely very much more resistant than the fallow which had been moldboard plowed. The basin listed plots which normally show considerable resistance to wind erosion, had eroded severely. The reason for the great amount of wind erosion on all moldboard plowed fallow was that the plots had not been cultivated since the heavy rain on July 17th. Under conditions prevailing this summer sub-surface tillage has been the most effective method of controlling both wind and water erosion on clean cultivated fallow."

Influence of Recently Incorporated Organic Matter on Resistance of Potatoes to Early Blight - L. T. Kardos, Durham, N. H.-

NORTHWOOD RIDGE RUNOFF PLOTS

	Early blight per compound leaf*
1. Oat & clover - clover hay - potatoes - potatoes (1946)	3.4
2. Potatoes - potatoes - potatoes - potatoes	13.8
3. Potatoes (winter rye) - potatoes (w.r.) - potatoes (w.r.) - potatoes	2.7

STRAFFORD RIDGE ROTATION PLOTS (severely eroded)

1. Annual - potatoes - potatoes - potatoes	4.1	(5 plots)
2. Annual - potatoes (winter rye) - potatoes (w.r.)-potatoes	3.6	(2 plots)
3. Annual - potatoes (manure) - potatoes (manure) - potatoes	0.3	
4. Two-year - perennial rye - potatoes	1.5	
5. Two-year - crimson clover - potatoes	1.0	(2 plots)
6. Three-year - oats & clover - clover hay - potatoes	1.1	
7. Three-year - oats & grass - grass hay - potatoes	1.7	

*Average from 20 leaves per plot at Northwood and 10 leaves per plot at Strafford, plots in duplicate at Northwood and in triplicate at Strafford except as noted.

"All plots had been dusted four times with a neutral copper (C-O-C-S) plus D. D. T. (3%) and had been uniformly fertilized with one ton per acre of a 5-10-10 fertilizer. The potato variety is Green Mountain.

"The data indicate a decided influence of recently incorporated organic matter, particularly nitrogenous organic matter, on resistance to early blight infection. At both experimental sites, the plots kept continuously in potatoes without organic additions were most heavily infected with early blight."

A Simple and Cheap Method for Determining Hay Yields - Bruno Klinger, Fort Collins, Colorado.-"Harvesting of plots was simplified this year by using the method Weihing and others with good results at the Colorado Experiment Station in working with alfalfa plots. Immediately or shortly after the hay has been mowed, it is raked and weighed. This green or semi-dry weight, as the case may be, is obtained by using a canvas bag collector and a milk scale. Immediately after the large sample has been weighed, a smaller one is drawn from it, placed in a paper bag and weighed with a more sensitive balance. After the small sample has been dried, a second weighing gives information for use in computing dry weight of the large original sample. This method simplified harvest and saved expense by:

1. Making it unnecessary to bag bulky individual samples.
2. Eliminating the need for a curing delay at harvest time.
3. Making unnecessary transportation of bulky and sometimes heavy plot samples to research headquarters for uniform drying.
4. Doing away with the need for storage space already very limited.

"The principal disadvantages are that:

1. Weighing in the field becomes impossible when air movement increases to a breeze.
2. Several more computing operations are necessary.

"The convenience, however, by far outweighs the inconvenience."

Lehmanns Lovegrass - Joel E. Fletcher, Tucson, Arizona.-"Lehmanns lovegrass is again demonstrating its superiority as a grass for reseeding deteriorated range lands. Although the results are outstanding, caution must be used in the selection of sites, since the grass is appreciably influenced by soil properties. This is particularly true of those factors associated with infiltration rates."

Grassland Agriculture - H. W. Black, Zonesville, Ohio.-"Fattening beef cattle on grass with a minimum of corn or other erosion producing crops at this station has attracted an unprecedented amount of attention and interest, from professional feeders, soil conservation workers, and just plain farmers down here in the hills of southeastern Ohio, who are trying to make a go of things on some of this long since worn out land which has reverted to poverty grass and broom sedge.

"Steers have maintained well over 2 pounds daily gain throughout the summer months on alfalfa-ladino clover-grass mixtures. It can be done."

Controlling Aquatic Vegetation with Benoclor - Henry Hopp, Beltsville, Maryland.-"In a field demonstration with the Sussex County, Delaware, Soil Conservation District, Benoclor 3C was applied to a severely infested drainage ditch on June 20. Water movement was about 1/10 foot per second, which is below the optimum for the treatment. Nevertheless, there was a rapid decrease in the vegetation for 1500 feet down the ditch, as shown by the following data:

Distance below place of application (feet)	Survival of water weeds after 12 days (per cent)
25	6
100	0
500	33
1500	50

Farm Weather Forecasts - O. R. Neal, New Brunswick, New Jersey.- "The Project Supervisor and Dr. Sterling J. Richards attended a meeting with representatives of the New Jersey Extension Service, the Seabrook Farms Organization, and the U. S. Weather Bureau concerning both the need and the availability of farm weather forecasts. It was pointed out that neither the general forecasts for a wide area nor the coast forecasts were well suited for farm use. A specific farm forecast would be helpful in planning a wide range of farm operations and would be particularly useful in connection with supplemental irrigation work."

An Interpretation of Soil Loss - Production Data - B. H. Hendrickson, Watkinsville, Georgia.-"Two cycles of the 3-year rotation of oats-sown lespedeza, volunteer lespedeza, and cotton were completed in 1945 on the 7 percent slope Class III runoff plots. Continuous cotton was grown alongside during this period. Identical fertilization was applied to all cotton. In the rotation the cotton per acre yields increased as erosion decreased. The continuous cotton yields varied but slightly with the seasons, but erosion was moderate to severe depending upon the number of excessive storms per year.

"The rotation was not completely represented on the runoff plots in 1944, and, of course, in the beginning year of the rotation, 1940, the cotton did not follow a soil improving crop.

"Considering only the cotton years of the rotation for the four years of record when cotton followed one or more years of lespedeza the average soil loss was 7.9 tons per acre and the yield averaged 951 pounds per acre of seed cotton. Continuous cotton soil loss for the same years averaged 40.3 tons per acre and the yield averaged 556 pounds per acre. Converted to pounds of soil loss per pound of cotton produced, the figures are 16.6 and 145.0, respectively, or in the ratio of 1:8.7.

"That is, the purely after-effect of the rotation "build-up" affected the soil during the cotton years of the rotation to the extent that it lost only approximately one pound of soil due to erosion per pound of cotton produced, to every nine pounds for cotton grown continuously."

DRAINAGE AND WATER CONTROL DIVISION

Hydrologic Studies - L. L. Harrold, North Appalachian Experimental Watershed, Coshocton, Ohio.-"The weather for August was favorable for good vegetal growth. Almost all of the 2.40 inches of rainfall went into the ground. Only on the corn watersheds was there soil and water loss. Straight-row cornfield lost 0.19 inch of water, whereas, contour cornfield lost 0.03 inch in runoff water.

"Most of this rainfall came in two storms, August 6 (1.06 inches) and August 15-16 (1.03 inches). Soil-moisture observations on new meadow (following wheat) before and after the latter storm showed that practically all of this 1 inch of rain went into the ground. Greatest increases in soil moisture were observed to extend down to depths of about 7 inches. Only slight increases were noted at greater depths. Three days after this storm noticeable increases in soil moisture were noted down to the 14-inch depth, whereas, the surface 7-inches were drying out.

"At the end of the month there remained 2 inches of water in the top 14 inches of soil on the new meadow. Percolation of water at the 8-foot depth continued throughout the month but at a very low rate. This continued percolation is due primarily to the fact that rainfall and soil moisture for the preceding months was fairly high."

Hydrologic Studies - J. A. Allis, Central Great Plains Experimental Watershed, Hastings, Nebraska.-"On August 5, 0.89-inch of rain fell which produced some runoff, and was followed by a 1.67 inch rain which fell in 36 minutes on August 7. The rainfall intensity for the 5-, 10-, and 15-minute duration exceeded the 10-year frequency expectancy according to Yarnell's data. The rain was centralized in the leased area and tapered off to about 0.65 inch in the lower part of the 3,500-acre watershed.

"Following is the table showing the intensity rates at the Meteorological Station.

August 8, 1946	5 min.	10 min.	15 min.	30 min.	36 min.
Intensity inches per hour	7.08	5.88	4.36	3.20	1.67

"Runoff exceeded 20 cubic feet per second on three of the 4-acre watersheds and reached a peak of 140 c.f.s. at gaging station No. 3 (481 acres drainage area); a peak of 95 c.f.s. was recorded at gaging station No. 5 (411 acres drainage area). Since it is contemplated that one of these areas be put in the best soil-conservation practices at a later date this storm should give us some good information on the calibration of these areas.

"Following is a table showing the peak flows on the small watersheds.

Straight rows	Contoured	Subtilled
In./hr.	In./hr.	In./hr.
	CORN	
4.99	0.34	3.61
6.59	5.63	2.83
		2.36
Ave. 5.79	2.98	2.93
	OATS	
2.20	.78	1.07
1.08	2.72	1.68
		2.03
Ave. 1.64	1.75	1.59
	WHEAT	
.84	5.42	1.89
4.97	4.94	1.10
		1.18
Ave. 2.90	5.18	1.39

"Native grass watersheds produced peaks of 0.19, 1.48, and 1.44 or an average peak of 1.04 inches per hour."

Hydrologic Studies - R. B. Hickok, Lafayette, Indiana.-"The following table shows results of yield sampling of wheat and oats on the Lafayette and Cromwell experiments, respectively, following one year's differential tillage treatment of the preceding corn crop:

Grain Yields from 1946 Crop Residue Management Experiments

Crop	Fertilization rate	Bushels per Acre (13.5 percent moisture) Treatment Numbers							
		1	2	3	4	5	6	7	8
Wheat (Lafayette)	High	25	26	29	26	27	27	31	29
	Low	24	20	23	24	25	24	27	25
Oats (Cromwell)	High	66	85	70	80	85	63	84	84
	Low	48	67	57	70	65	63	69	72

Treatment numbers refer to the initial tillage treatment for corn on the same plots in 1945. The tillage treatment for wheat was to disc all plots once prior to seeding, and for oats all plots were disced twice. Corn stalks were knocked down and partially cut up, and depth of tillage was from 2 to 3 inches.

"Tillage treatments prior to seeding corn on the plots in 1945 were as follows:

Treatment No. 1 Surface mulch, no root bed preparation except that produced by seeding and fertilization.
2 Surface mulch, tillage to 3-inch depth.
3 Surface mulch, tillage to 7-inch depth.
4 Residue mixed, 0-3 inch depth, tillage 3-inches.
5 Residue mixed, 0-3 inch depth, tillage 7-inches.
6 Residue mixed, 0-7 inch depth.
7 Residue turned under, 6-7 inches.
8 Residue turned under, 4 inches (approximately).

"Yield data from the 1946 wheat and oat plots have not yet been analyzed statistically. There appears to be significant differences due to fertilization and probably some difference due to tillage treatment. High fertilization consisted of 500 pounds of 8-8-8 on corn, and 400 pounds of 0-14-7 on wheat, and 400 pounds of 3-12-12 on oats. Low fertilization consisted of 150 pounds of 0-14-7 on both corn and wheat at the Purdue Throckmorton Farm, and 150 pounds of 3-12-12 on both corn and oats at the Harper Farm."

Hydrologic Studies - R. G. White, East Lansing, Michigan.-"The current drouth is one of the most severe mid-summer drouths ever to occur in the East Lansing area. From June 20 to August 31, a total of 0.78 inch of rain fell at the cultivated watersheds. During this same period of time, only 0.70 inch of rain fell at the stubble-mulch plots, but the wooded watershed fared some better with a total of 1.52 inches."

Hydrologic Studies - John Lamb, Jr., Ithaca, New York.-"Precipitation over the watersheds for August was low by 0.70 inch, as compared to the 10-year station average. Rain fell on only 9 days during the period, maximum concentration occurring during the week of August 4 and the week-end of the 11th. Peak runoffs resulted from the storm of the 4th, when intensities of 0.2 to 0.3 inch fell in 5 minutes, with a total of 1.12 inches within 7 hours. This storm, however, was preceded by those of July 31 and August 1 in the amount of 1.63 inches, which produced very little runoff due to a previous dry spell. Woodland watersheds No. 1 and 5 ceased flowing on June 19. Rains of May, June and July produced heavy growth of foliage, and their continued need for moisture and high transpiration, no doubt, was a contributing factor for low runoff during August.

August data

	Watersheds				
	#1 Idle land	#2 Idle land	#3 Idle land	#4 Wood land	#5 Wood land
Maximum temperature	84	-	-	78	79
Minimum temperature	42	-	-	46	47
Average maximum temperature	80	-	-	75	75
Average minimum temperature	49	-	-	51	51
Precipitation, inches	3.62	3.60	3.60	3.59	3.34
Peak flow, inches per hour	0.046	0.016	0.020	0	0

Runoff Studies - V. D. Young, Fayetteville, Arkansas.-"Northwest Arkansas experienced the driest August since 1929. There were three days during the month on which precipitation occurred on all the stations and 4 days on which it occurred for two of the stations. The monthly totals varied from .83 inch to 1.10 inches with a mean for all gages of 1.00 inch. There were 22 days with temperatures which were 90° F. or above. Only a trace of runoff occurred from one watershed, namely the cultivated area and this on August 9th.

"There were six days during which rainfall occurred on the Muskogee watersheds for the period August 1 to August 26, inclusive. The monthly totals varied from 1.81 inches on the terraced area to 2.79 on a pasture area. The mean precipitation was 2.16 inches. Runoff occurred from one watershed, namely W-III, due to a 1.66 inch rain on August 5. The peak rate of runoff was .682 inch per hour.

"The monthly records from Garland, Texas show that approximately a 4.2 inch rain occurred on all the watersheds August 28th and 29th. The amounts occurring on the several watersheds on these days ranged from 3.38 inches to 4.25 inches. Only a trace of runoff occurred to partially fill the pond back of the weir on Station W-I. This watershed was in corn with a small area above the weir in meadow. Due to the extreme dry weather these soils undoubtedly contained numerous large cracks which absorbed the high precipitation."

Runoff Studies - T. W. Edminster, Blacksburg, Virginia.-"At the request of Operations the Project Supervisor, together with J. P. Walker, Drainage Engineer, R. E. Devereux, State Soil Scientist, James Littleton, Soil Conservationist, and T. M. Heppler, County Agent, examined two farm pond sites in the Riner section of Montgomery County. An examination of these sites showed conditions typical of sites in the Ridges and Valleys section of Virginia. One area having a watershed of nearly 100 acres was heavily cultivated, a large portion of which is on a neighbor's farm and hence not under the pond owner's control. The dam site was underlaid with a shaley porous soil that carried underground the entire flow of a small spring. The valley sides had prominent out croppings making it impossible to develop adequate borrow pits or even to develop a storm spillway to care for the extreme watershed conditions. The second site presented an entirely opposite condition; 10-12 acres of dense pasture on a rather highly absorptive soil type. Although topography, soil for dam construction, and other items were probably adequate there is extreme doubt that there is sufficient watershed area to care for the pond. These two sites embodied practically all of the problems now facing Operations personnel and which they are looking to Research for answers.

"Records of the Bent Creek experimental watersheds were plotted.

"Probable 10-year peak rates were determined for certain of the cultivated watersheds. Size factor curves based on these 10-year values were developed for both the Bent Creek watersheds and the Blacksburg watershed. The two curves checked very closely giving added strength to the Blacksburg data as a basis for the Ridges and Valleys hydrologic report.

"Further analysis of the Bent Creek data shows that the size factor curve developed on the basis of the theoretical 10-year values checked closely with the size factor curve developed from actual high peak concurrent storms. These results further strengthen and support the analysis. Final checks are now being made on these data; work is being started on the actual manuscript preparation."

Runoff Studies - N. E. Minshall, Madison, Wisconsin.-"Precipitation for the month at Edwardsville was 16.04 inches, most of which occurred during the first half of the month. This amount in one calendar month has been exceeded only once in the 109 years of record of the St. Louis Weather Bureau. The maximum monthly amount, which they had recorded, was 17.07 inches in June, 1848. Over one-half of the total rainfall for the month came in two storms on the nights of August 14-15 and August 15-16. The maximum amounts of rainfall for 12-, 24-, and 36-hours was 5.17, 5.53, and 9.02 inches, respectively. According to U.S.D.A. Miscellaneous Publication No. 204, the 24-hour precipitation has a frequency of once in every 25 years. The total runoff for the month was about 7.5 inches, which is relatively low considering the rainfall, and no doubt due to the dry condition of the soil at the beginning of the month. The intensities for 20 to 30-minute periods exceeded any previous rates during the 9 years of record, and likewise, new maximum rates of runoff were established on all watersheds. The table on page 19 shows data on amounts and rates of rainfall and runoff for the 3 watersheds for the storms of August 14-15 and August 15-16.

Comparison with Published Results - D. B. Krimgold, Washington, D. C.-"The August 14-15, 1946 storm at Edwardsville, reported by N. E. Minshall, is quite outstanding. The rainfall intensities for 20- and 30-minute periods and the peak rates of runoff were the highest recorded in the 9 years of observation. The expectancies of these new rates of runoff cannot be determined without analyzing them together with those previously obtained. Even then their reliability will depend on how good a sample the 9 years are of a longer period. It is, however, interesting to compare them with the design values, derived from a 6-year record, 1938-1943, at Edwardsville, and shorter records elsewhere in the Claypan Prairies (Muskogee, Oklahoma, and McCredie, Missouri). See Figures 3 and 4 of SCS-TP-56, 'Hydrologic Design of Farm Ponds and Rates of Runoff for Design of Conservation Structures in the Claypan Prairies'. This comparison is shown in the following table:

Watershed No. and Type	Drainage area	Rates of Runoff: Design values TP-56	Storm August 14-15, 1946	Column 4-Column 3 / Column 3
1	2	3	4	5
	Acres	In./hr.	In./hr.	Percent
W-I Cultivated	27	3.82	2.56	-33
W-II Pasture	50	2.88	3.00	+ 4
W-IV Mixed Cover	290	2.60	2.82	+ 8

"The values given in SCS-TP-56 are considered to have a 4 percent expectancy meaning that over a long period of time such as 50 or 100 years they can, on the average, be expected to be equaled or exceeded once in 25 years. If the values of TP-56 are assumed to be correct the expectancy of the August 14-15, 1946, rates of runoff was considerably lower than 4 percent on W-I and only slightly higher on W-II and W-IV. The somewhat lower total rainfall and the relatively low intensities for 5-, 10-, and 15-minutes offer a partial reason

EDWARDSVILLE, ILLINOIS

Watershed	Drainage Area	Total Rainfall	Duration of Storm	Maximum Rainfall Intensities for Selected Time Intervals Inches per Hour					Runoff Max. Rate	Runoff Total	Runoff Percent of Rainfall
	Acres	Ins.	Min.	5 Min.	10 Min.	15 Min.	20 Min.	30 Min.	In/hr.	Ins.	
Storm of August 14-15, 1948											
W-1 Cultivated	27.2	4.90	450	4.90	4.90	4.88	4.50	3.62	2.56	3.80	77.5
W-2 Pasture	50	5.13	450	5.64	4.98	4.80	4.56	3.86	3.00	3.48	67.8
W-4 Mixed Pasture Woods Cultivated	290	5.17	450	5.00	4.98	4.92	4.62	3.88	2.82	3.41	66.0
Storm of August 15-16, 1948											
W-1 Cultivated	27.2	3.92	820	2.78	2.58	2.20	2.01	1.74	1.05	3.19	81.4
W-2 Pasture	50	3.85	820	2.76	2.67	2.36	2.10	1.86	1.27	3.00	78.0
W-4 Mixed Pasture Woods Cultivated	290	3.85	820	2.76	2.67	2.36	2.04	1.86	.90	2.67	69.4

for the difference between W-I and the other two watersheds. However, rainfall amounts and intensities being only one of the factors affecting rates of runoff, these differences can be properly explained only after the analysis referred to above. It will be well to point out that on August 14, 1946, 14.1 of the 27.2 acres of W-I were in timothy (4 inches high), 7.4 acres were in wheat stubble, and the remaining 5.7 acres were in corn (8 feet high). The cover on W-I was obviously not conducive to high rates of runoff. Also the values given in TP-56 for cultivated land up to about 50 acres cannot be considered as reliable as those for larger areas in cultivation or in mixed cover and for watersheds in pasture. The TP-56 values for small cultivated areas are based on only three years of record (1938-1940) from W-I at Edwardsville, when it was in cultivation and on a somewhat incomplete and less reliable 5-year record (1939-1943) from a 22-acre cultivated area at Muskogee, Oklahoma.

"In the light of the information just cited it would appear that the TP-56 values for pasture and for relatively large cultivated and mixed cover watersheds, may have so far withstood the test. This statement is, of course, subject to analysis, which may or may not confirm the assumption that the rates of runoff on W-II and W-IV had an expectancy of 4 percent (once in 25 years on the average). In one more year, if the studies at Edwardsville are continued, it will be possible to compare values based on a 10-year record with the TP-56 values derived from a 6-year record."

"Precipitation at Fennimore for the month was 3.80 inches, which was quite well distributed and resulted in no surface runoff. The corn in this section is generally in good shape but will require at least a month to mature. The minimum temperature was 40 degrees on August 28 and September 2. White frost was observed in all the valleys on the morning of September 2, but no information is available if there was any material damage."

Research Explains Performance of Farm Ponds - George W. Hood, Batesville, Arkansas.-"A practical demonstration of the value of our research work on soil and water losses was found by an inspection and study of a farm pond on a farm of one of our Co-operators.

"This pond was well constructed, and the workmanship was good, but it was a failure because it did not serve the purpose for which it was built, namely to provide stock water.

"A careful survey of the area was made before the pond was built and it was thought a sufficient acreage was available to furnish ample runoff to fill the pond. However, as a safety measure, two long diversions were constructed to carry off more water to the pond but this added safeguard, and rain totaling 25.70 inches, with March furnishing 4.89 inches of rain, April 6.02 inches, and May 14.79 inches, the pond received only a trickle of water and that in the deepest part and by July was entirely dry.

"This pond was located in a pasture with a luxuriant growth of Bermuda grass, probably sufficient to furnish good feed for more than one animal unit to the acre, but the area did not provide any runoff water because of the ground cover.

"The records of our work, over a period of 5 years, shows that the runoff from Bermuda grass is slightly over one percent of the rain that falls. This small runoff on grass would indicate that to have sufficient water from a good pasture, to fill a pond, the acreage should be considerably larger than where other ground cover or plowed ground furnishes the runoff. When a farm pond is built, a careful study should be made of the area, the type of farming, and the crops that are grown, in order to determine the likely amount of runoff water that will be available to fill a pond. Good pasture, well managed, usually will not supply sufficient runoff for a stock pond.

D. B. Krimgold of the Washington office, who inspected this pond together with Wallace W. Lytle, Work Unit Conservationist for Ark. S.C.D. #15, V. D. Young and G. W. Hood on July 16, 1946, adds the following from the notes he kept in the course of an extensive examination of farm ponds in northern Arkansas:

"The pond is on the Nils Barnett farm near Batesville. According to Mr. Lytle's record, the drainage area is 3.3 acres of pasture; the storage capacity of the pond is 2.0 acre-feet; the water surface area at spillway elevation is 0.5 acre, 40 percent of which has a depth of 6 feet or more. The pond was completed on March 3, 1945, and was dry until after the heavy rains in May, 1946, when it filled to the depth of 4-1/2 feet. It was dry on the date of inspection. Records from the Fayetteville plots of the Arkansas Agricultural Experiment Station and from the Bentonville Runoff Studies would show that for Bermuda grass on the highly permeable Ozark Highland soils, runoff is considerably less than 1 percent of the rainfall that can be depended upon 9 out of 10 years, or even 4 out of 5 years. Mr. Hood's conclusion regarding the size of the drainage area is, therefore, quite important.

"It must be pointed out that in this particular case the seepage factor is also involved. According to Mr. Lytle, there were 4-1/2 feet of water in the pond after the May, 1946, rains, and that it all disappeared in less than six weeks. Some of this water was, of course, derived from the 25.7 inches of rainfall which fell not only on the watershed but also on the pond. Even assuming exceptionally high rates of evaporation (2 ft. for 6 weeks), we would still have to account for 2-1/2 feet, the lion's share of which must have been lost by seepage. Use of water by cattle is comparatively so small that it can be neglected in this analysis.

"The seepage problem is brought out, not to distract from the drainage area which is all important, but to emphasize the need for treatment to reduce seepage to a reasonable amount and then provide sufficient drainage area so that after evaporation, reasonable seepage and beneficial use of water are provided for, a favorable balance is obtained, not only during wet years, but particularly during droughts, when the water is most urgently needed. Farm ponds are quite often the key to sound land use adjustment on the farm. The proper planning of farm ponds involves many difficult problems, for which answers must be found."

Hydraulic Studies - F. W. Blaisdell, Minneapolis, Minnesota.- "Mr. Anderson found from the analysis of the data obtained on the 1-1/8, 2-1/4 and 4-1/2 inch diameter pipe drop-inlet culvert models that for the head-discharge curve the comparison between the 2-1/4 inch diameter model and the other models was poor. The comparison between the 1-1/8 and 4-1/2 inch models was fairly good. Hydraulic grade lines for similar rates of flow were then plotted for each of the models. The observed pressures compared satisfactorily indicating that similarity existed within the pipe-drop inlet even though the head-discharge curves were inconsistent. Our attention was then directed to the inlet as the source of the trouble. A study of the available data and a few tests indicate that lack of similarity in the flow behind the headwall causes the discrepancies. Circulation behind the headwall causes a vortex to form at the inlet. This vortex was relatively much more intense for the 2-1/4 inch model than for the others. Since the decrease in discharge, due to the vortex, was as great as 20 percent, its elimination is essential. The circulation behind the headwall will be eliminated and additional tests conducted.

"Mr. Donnelly has completed the taking of 16 mm. colored moving pictures showing the performance of the box-inlet drop spillway outlet. Editing of this film has not yet been attempted. When complete, this film will show a damaged field structure and will present the results of the hydraulic model tests. Specificially, a comparison will be made between the full model and the half model used during the test program to show that the half-model technique gives valid results. The benefits of the longitudinal sills and the end sills will be shown. It will be shown that this outlet can be adapted to wide or narrow gullies and may be used as an outlet for highway culverts. It will be shown that the height of the drop does not affect the performance of the outlet. The very great effect of the wingwall will be shown in a series in which no wingwall is used and in which the presently used type of wingwall is compared with the triangular wingwall developed here. The film will conclude with a view of the outlet designed according to the criterion established as a result of the studies conducted here.

"Mr. Donnelly and Mr. Christopherson, an L.A. laboratory mechanic, constructed a test channel having an entrance section 12 feet long and 10 feet wide and an outlet section 10 feet long and 5 feet wide in which the submergence tests of the box-drop inlet spillway will be conducted. Mr. Donnelly calibrated the measuring flume to be used for this study and started the construction of a box inlet drop spillway structure."

Hydraulic Studies - W. O. Ree, Stillwater, Oklahoma.-"The tests run during the month of August are listed in the following table:

Table 1

Channel	Expt.	Cover	Bed slope	Bottom width	Side slopes	Number of flows
U1	3	Bermuda grass, green, long	0.05	3	(1)	8
U4	2	Ischaemum, green, short	.05	3	(1)	2/ 5
U5	4	Lovegrass, green, medium	.05	3	(1)	2/ 5
U6	4	Lovegrass, green, long	.05	3	(1)	2/ 4
U8	1	Mixture 3/, green, long	.05	3	(1)	12
FC3A	2	Bermuda grass, green, long	.03	0	10:1	10
FC3B	2	Bermuda grass, green, long	.06	0	10:1	10

1/ Vertical plywood sides

2/ Low flows (no bending or submergence of vegetation)

3/ Originally Brome, however other volunteer vegetation predominated.

"Mr. V. J. Palmer has started work on a technical paper (as co-author with Mr. M. B. Cox of Guthrie) covering all the channel work done by Mr. Cox at Stillwater. This paper is tentatively titled 'Results of Tests on Vegetated Waterways.'

"Experiment 1 on channel U10 was run in July. Preliminary calculations have been completed and some results can be offered.

"Channel U10 had a cover of Sudan grass. Stand counts showed an average of 23 plants per square foot with an average height of 33 inches. The maximum height was about 66 inches. In general the stand was very good. In addition to the Sudan grass there was considerable crab grass in the channel averaging about 40 stems per square foot.

"The channel is of the 'unit type' having a flat bottom 3 feet wide and vertical plywood sidewalls. The bed slope is 0.05 foot per foot. The soil is Daugherty silt loam.

"The principal hydraulic data are given in the following table:

Table 2

Flow No.	Q cfs	Depth feet	Slope ft/ft	Velocity ft/sec.	Manning's n	VD 1/
5	0.07	0.05	0.048	0.43	0.11	0.023
6	.17	.10	.048	.55	.13	.055
7	.38	.18	.048	.70	.15	.128
8	.64	.27	.047	.79	.17	.215
9	1.12	.39	.046	.95	.18	.373
10	1.67	.51	.047	1.09	.19	.557
11	4.04	.72	.051	1.88	.14	1.35
12	7.40	.84	.052	2.94	.10	2.47
13	11.4	.95	.050	4.01	.080	3.81
14	20.9	1.12	.049	6.23	.057	7.01
15	31.5	1.31	.045	8.06	.047	10.6

1/ Product of velocity and depth.

"A plotting of these data showed this cover to lie between the highest and second highest of the four retardance groups selected by this project (described in May, 1946 progress report)."

Sedimentation Studies - Carl B. Brown, Washington, D. C.-

"L. C. Gottschalk made a multiple regression analysis of sedimentation data for the Colorado River Basin of Texas. This type of analysis is used to determine the function of various factors relating to sedimentation of reservoirs and is a new approach to the problem of interpreting existing data. The results in this basin showed that drainage area, reservoir capacity, age, and land use account for 91 percent of variability of sediment accumulation. This is a very good correlation. However, the results indicate an analysis of this kind should not be made when data have extremely wide limits of values, but rather that the data should be grouped according to watershed and capacity sizes and an analysis made for each size group.

"A paper entitled 'Aspects of Protecting Storage Reservoirs by Soil Conservation' by C. B. Brown was published in the first issue of the Journal of Soil and Water Conservation, July 1946. This article discusses the practical aspects of protecting storage reservoirs by watershed-treatment programs under five headings: (1) The rate, character, and sources of sediment production from the watershed, (2) the effects of the so-called capacity-watershed (C/W) ratio on the rate of silting, (3) the relative value of dam sites as determined by their abundance and the demand for the services which their utilization can produce, (4) the economic pressure of the discount rate in computing benefits from sedimentation control, and (5) the time required for application of soil-conservation practices, the costs involved, and the results to be expected from watershed treatment. The paper attempts to present an objective approach from the standpoint of the river-basin engineer and conservationist to evaluating the physical and economic factors involved in protection of storage reservoirs by watershed treatment."

Drainage Studies - W. J. Liddell, Athens, Georgia.-"The cement asbestos main line pipe arrived on July 1, and was installed on the 2nd of July. Now the complete irrigation system is ready to supply water to any of the test plots; the two line system can be used in which one line can be connected while the other is operating, thus effecting a saving of time.

"Cultivation of the corn and vegetables continued. The corn was laid by in July after two cultivations. Former cucumber, squash, turnip, okra, and pepper plots were replanted in July to cowpeas, collards, late beans, beets and squash. Irrigation has shown up particularly well in germinating collards and assisting early growth.

"It was desired to try out to flexibility of the portable system and study its adaptability to general field conditions. Arrangements were made with the Southern Piedmont Experiment Station at Watkinsville for us to irrigate 3 acres of corn on the tenant-operated farm unit using water from a 1-1/3-acre fish pond. The corn was first irrigated on July 23 and 24 and a second time on August 20.

"At the plot site on the University Farm the corn was irrigated two times, being given 2 inches of water each time. The pasture has been irrigated once with 2 inches; both the pasture and the corn were last irrigated the week of August 12. Vegetables have been given supplemental irrigation to supply at least 1 inch of water per week. Irrigations were made on July 10, 19, and 30, and August 9, 12, 16, and 19."

Drainage Studies - R. E. Morris, North Liberty, Indiana.-"Subsidence surveys were completed on one farm and partially completed on another. We intend to finish as much of this work as possible before cold weather.

"Work was begun on the process of cleaning and providing new filter gravel for the remote reading corner wells. We hope to do this in such a way as to insure more accurate water-table readings and also to provide better protection against the gages being filled with sediment. To date, this type of manually reading gage has been quite satisfactory.

"The work of shoring up the ditch banks in the return channel is now finished."

Drainage Studies - James Turnbull, Lake Alfred, Florida.-"During the month work was continued on the development of a satisfactory spray nozzle for portable pipe and some changes in the design were made which produced a finer spray.

"New gypsum blocks were installed in all irrigation plots to determine soil moisture by the electrical resistance method. Records on the amount of rainfall intercepted by orange and grapefruit trees were continued and are now available for a total of 19 rains. Orange trees continue to intercept less rainfall than grapefruit trees with the average for the 19 rains showing 14.6 percent interception by orange trees and 20.5 percent interception by grapefruit trees. However, the outer ring of measuring cans under the orange trees

are at the leaf drip, and the elimination of this ring of cans changes the average interception by orange trees to 19.1 percent for the area inside the leaf drip. All cans under the grapefruit trees are inside the leaf drip.

"The water-table wells rose steadily during the month, rising at a greater rate than the lake level. The elevation of the water in the wells is now slightly over a foot above lake level."

Drainage Studies - T. W. Edminster, Blacksburg, Virginia.-"Upon return from the Soil Decline Meeting in Cincinnati on August 1 attention was turned to a study of the two films, 'A Gas Attack on a Small Village' and 'Density Current Flows' as prepared by Soil Conservation Service personnel at California Institute of Technology and sent to the Project Supervisor by Mr. Vito Vanoni. Members of the Agricultural Engineering Staff and of the Horticulture Department studied these films for a possible technique that could be used in pre-determining air-drainage flow and currents in potential Virginia orchard sites. It is believed, after studying the films, that with careful selection of a smoke of proper density and due consideration given to temperature and wind, it would be possible to trace out the air-drainage pattern of an orchard site through the use of smoke generation. The Project Supervisor is working with Dr. E. L. Overholser, Head, Department of Horticulture, and with various members of his staff on this problem. If such a technique could be developed, it would aid farm planners in developing planting systems that would place frost susceptible varieties in the better drained areas and the hardy varieties in the most poorly drained areas. Such information would be most valuable in the vast fruit producing areas of Virginia."

IRRIGATION DIVISION

The following report is for the month of July.

Irrigation Efficiency Studies.-In preparation for irrigation efficiency studies in Antelope Valley, Mr. Aronovici reports that a site for the study of the irrigation of alfalfa had been selected. It consists of border strips 30 x 650 feet, uniform grade of 0.36 percent, reasonably uniform soil profile of sandy loam to clay loam soils. The volume weight of the soil was found to vary between 1.52 and 1.68 and that soil moisture samples taken 48 hours after irrigation indicate a field capacity between 14 and 17 percent. Preliminary runs of wilting range, using the Richards pressure plate at 15 atmospheres, indicates an approximate wilting range of from 6 to 10 percent. This value appears high and will be checked by making additional runs.

Mr. Barrett reports.-"A manuscript entitled 'A Brief Discussion on the Development and Organization of Data on Irrigation Requirements' has been completed. This manuscript includes a compilation of irrigation requirement data for Oregon crops. It will be available for limited distribution."

Methods of Water Application.-Mr. Criddle reports his assistance to operations at St. Anthony and Coeur d' Alene, Idaho in determining proper size of stream, length of run, and time required for proper irrigation of the various soils and slopes found in these areas. He found, for instance, that on similar slopes the percolation rate of water into the soil on Yellowstone Soil Conservation District was only about 1/2 gallon per 100 feet of furrow as compared to about 3 gallons per minute in the Kootenai Soil Conservation District. Also it was found that water went into the ground at the rate of about 9 gallons per minute per 100 feet on a slope of 0.3 percent as compared to about 0.4 gallons per minute per 100 feet of furrow on a slope of 7.6 percent. Both these measurements were made on similar soils in the Kootenai Soil Conservation District.

Evaporation - Transpiration Losses.-Muckel's analysis of the meteorological records at San Diego and Escondido shows that during the 58 years record the minimum annual rainfall was 5.82 inches. The average of the two successive driest years was 8.28 inches, and the average annual of the driest three year record was 9.75 inches. All of these amounts are less than the consumptive use of hillside vegetation. The 58-year average annual rainfall at Escondido is 16.71 inches. An analysis of the precipitation record at San Diego and Escondido shows that the area is now experiencing the wettest period on record.

Young reports his study of "Evaporation in California" is practically completed. This study includes records from some 200 evaporation pans covering periods of 1 to 35 years. It also includes temperature and wind records for some stations. Young finds that the wide range in climatic conditions within the state due to both altitude and latitude and to differences between coastal and desert areas makes a map of the state showing lines of evaporation of doubtful value. Young finds further that in spite of the importance of relating the evaporation from a small land pan to the evaporation from a lake or reservoir, there appears to be little consistency in choosing coefficients for reducing pan records to equivalent depths of loss of larger water areas as practiced by a number of water agencies.

Storage of Water Underground for Irrigation.-Muckel reports that in the San Joaquin Valley considerable evidence has been obtained from previous experimental work that the most efficient method of spreading water is to pass it over the land in a thin sheet instead of ponding it at greater depths. The present facilities do not permit this method of spreading and a search is now being made to find an area where continuous spreading in a thin sheet can be tested. One of the principle drawbacks is that a continuous supply of water is needed and that spreading should continue over the 12 months of the year.

Seepage Losses from Canals.-Bloodgood reports the issuance of a mimeographed report covering seepage losses from canals in Texas. This report consists of five heretofore unpublished special reports on seepage losses in Texas canals. The records are old but furnish much valuable information relative to canal seepage losses. Bloodgood further reports that the annual progress report on silt studies in Texas will be available in early August.

Canal Lining.-Rohwer reports the completion of a Manual on Canal Lining prepared at the request of the Operations Division, Region VI. This report contains descriptions of projects where different types of canal linings have been used and the methods of construction and cost of various types of canal linings.

Lauritzen reports the completion of unit linings in channel A of the field laboratory. Controlled tests have begun and some preliminary measurements made.

Sand Traps.-Parshall reports the completion of two hydraulic models of sand traps. The first, a riffle deflector-vortex tube (Scale ratio 1:6) and second, an apparatus to study the problem of creating a vertical or spiral flow in a semi-circular channel. Both of these apparatus are designed to remove bed load from irrigation channels.

Flow of Water in Pipes.-Scobey reports that his analysis of the five most used formulas for flow of water in pipes, using selected sizes of pipe ranging from 3 inches to 30 feet in diameter and with velocities ranging from 2 to 10 feet per record for smaller sized pipes and to 15 feet per record for the larger sizes, indicates that a single formula with a uniform exponent of velocity and diameter can be developed which will give results within the required degree of accuracy for flow in pipes.

Utah Investigations.-Maughan reports a total of 202,467 acres in drainage districts in Utah of which only 83,168 are effectively drained. Surface and subsurface drains have been constructed for an additional 62,669 acres but the systems are ineffective and 56,630 acres within the districts have not been drained. The average cost of drainage is $43.00 per acre.

Customs, Regulations and Laws Affecting Farm Irrigation and Drainage.-Hutchins reports the completion of his manuscript entitled "Desirable Principles of State Water Legislation". This paper after approval will be presented at the National Reclamation Association Meeting at Omaha, Nebraska in October.

The Bureau of the Budget has cleared the form of schedule to be used in cooperative project (SCS-BAE) entitled "Studies of Irrigation Enterprise Organization" and this project is now actively under way.

Infiltration - Mech reports.-"A progressive increase in the infiltration rate over newly seeded alfalfa plots as the season advanced. The infiltration rates in the early season were 0.1 and 0.26 inch per hour, respectively, on the seven and two percent slopes. The infiltration rate on the old seeding appears to be stabilized. The relatively hot and dry July made its usual heavy demand on the soil moisture supply. In order to maintain the three ranges of available soil moisture, a total of 48 plot irrigations were made during the month.

Erosion from Irrigation.-"Soil losses from alfalfa from the first irrigation after reditching (corrugation) after record cutting are large. Calculations are not completed but inspection of furrows indicated losses approximately those from row crops. It seems that the severe soil disturbance accompanying reditching leaves the furrow itself in a condition not unlike that under a row crop."

Miscellaneous.-An article entitled "Farm Weed Burners" has been prepared by William W. Donnan at the request of the Regional Engineering Division. This article has been submitted for review and upon approval will be duplicated for operations personnel.

During the month Dr. M. L. Nichols, Chief of Research, SCS, and Mr. F. G. Bell, Chief, Division of Erosion Control Practices accompanied George D. Clyde, Chief of the Division of Irrigation and Water Conservation on an inspection of the research program of the service in New Mexico, Arizona, California, Nevada, Utah, Colorado, and part of Idaho.